



Climate change and high-quality winegrowing in California: Ecological impacts and potential farm-scale adaptation

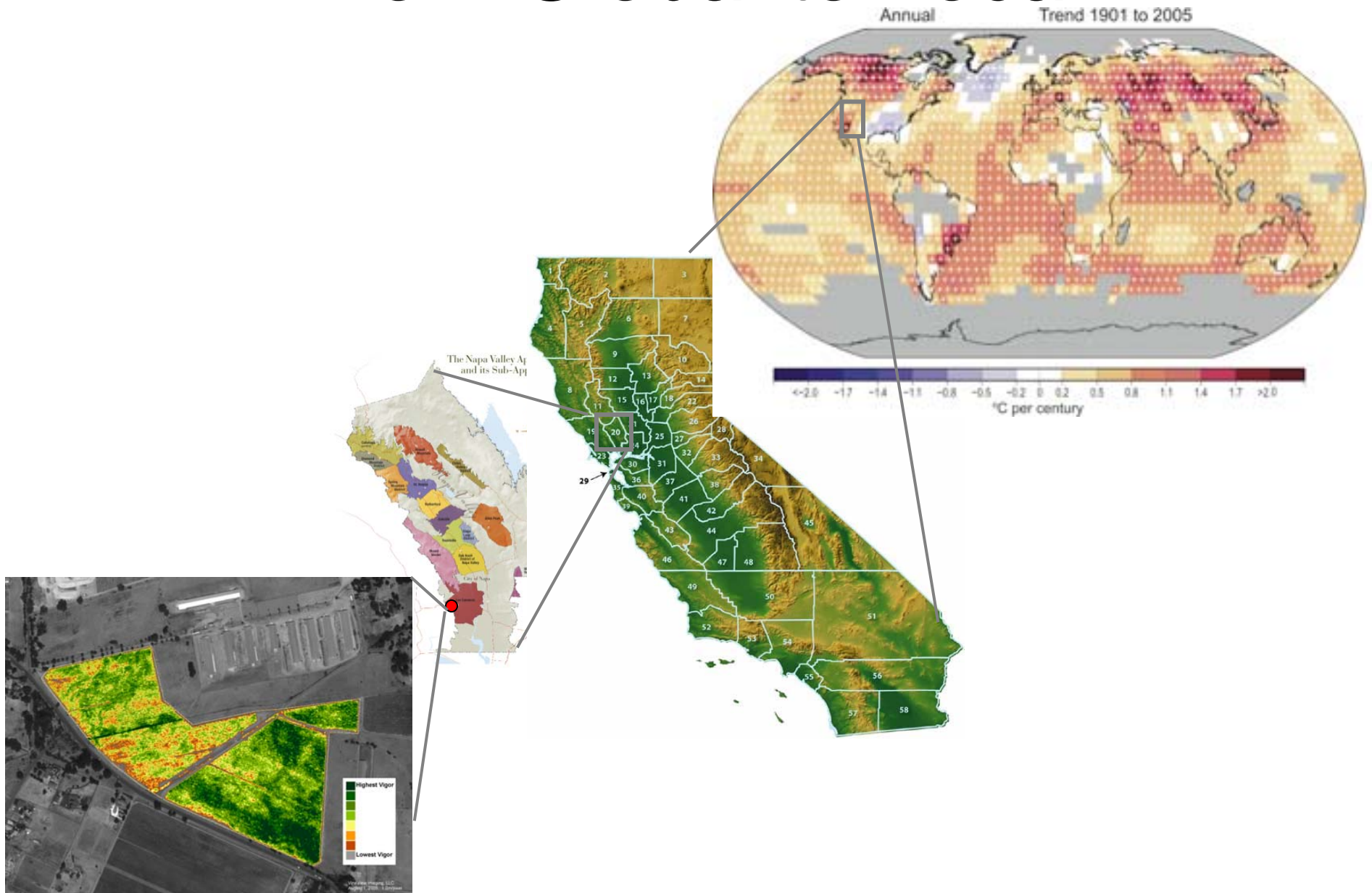
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California Department of Water Resources

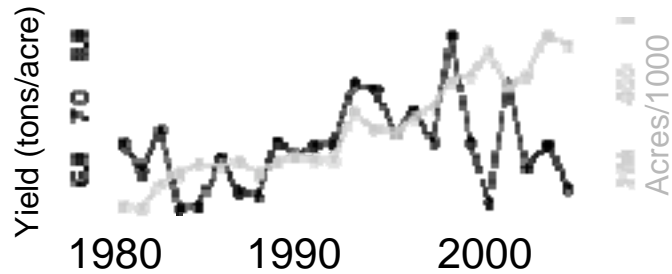
26 January 2009

From Global to Local



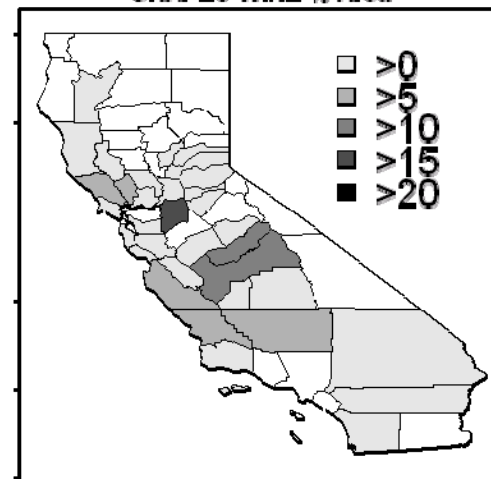
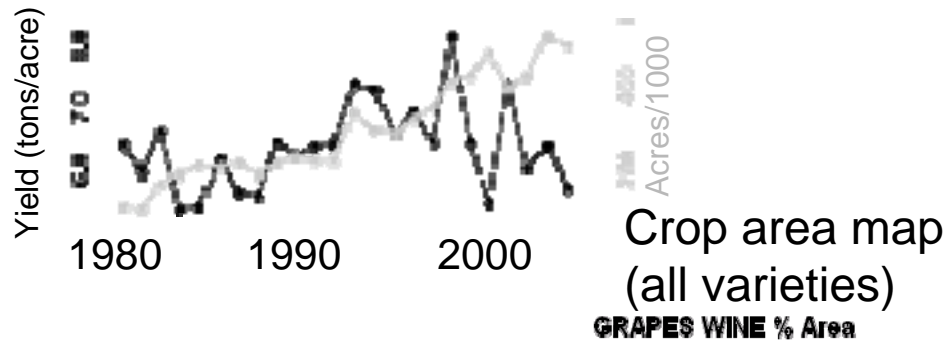
Modeling Historical Climate & Yields

State time series, 1980-2003 (for 12 crops)



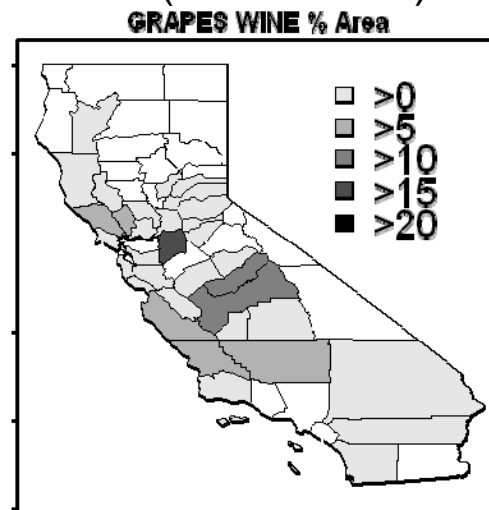
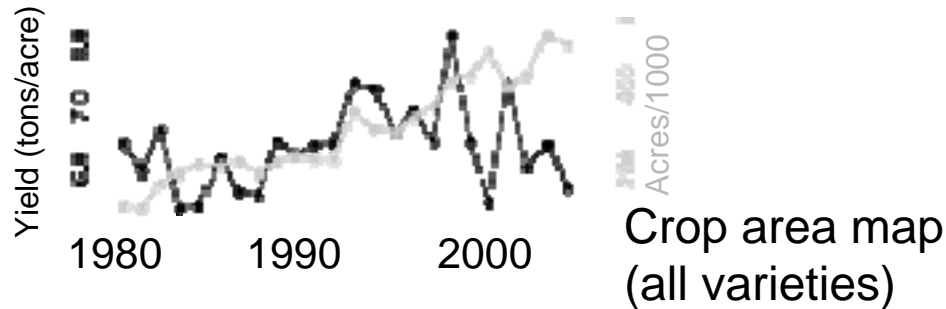
Modeling Historical Climate & Yields

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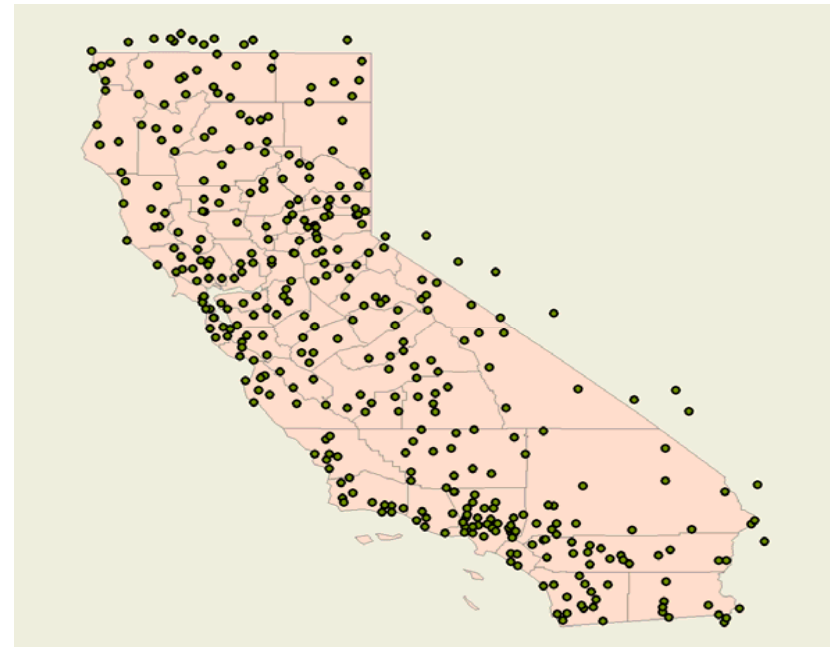


Modeling Historical Climate & Yields

State time series, 1980-2003 (for 12 crops)

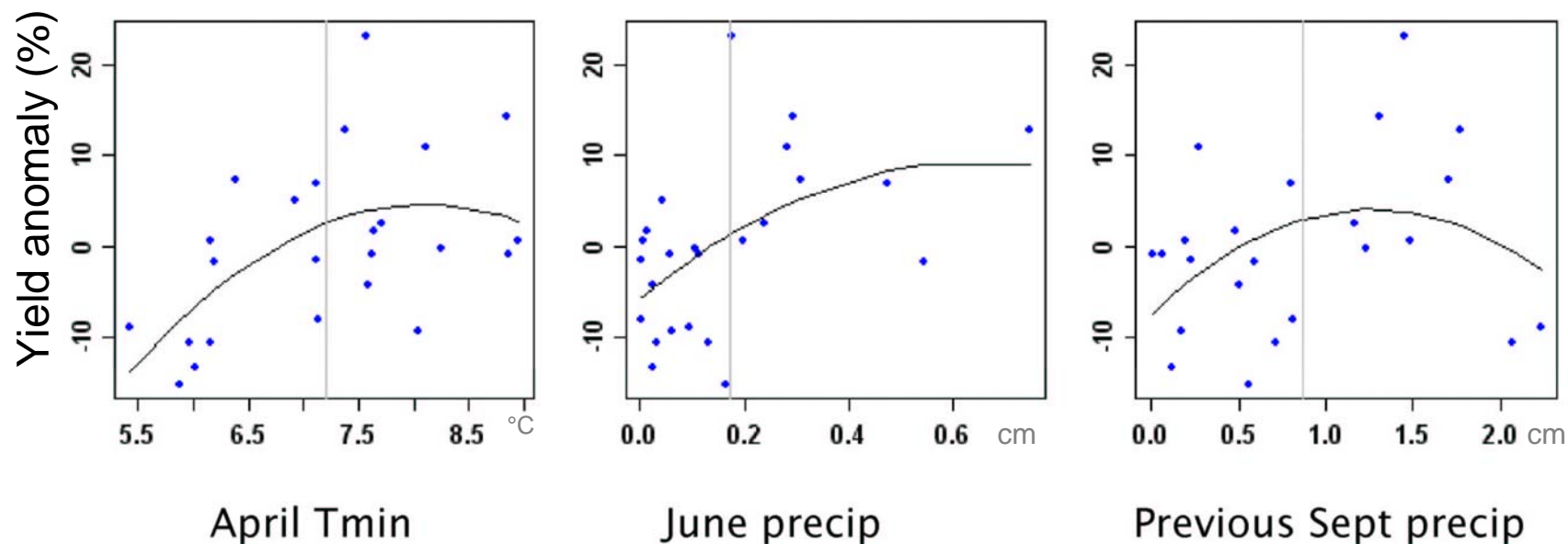


+ Daily weather data from 382 stations
(Tmin, Tmax, precip)



Lobell, Cahill, and Field, 2007, *Climatic Change*

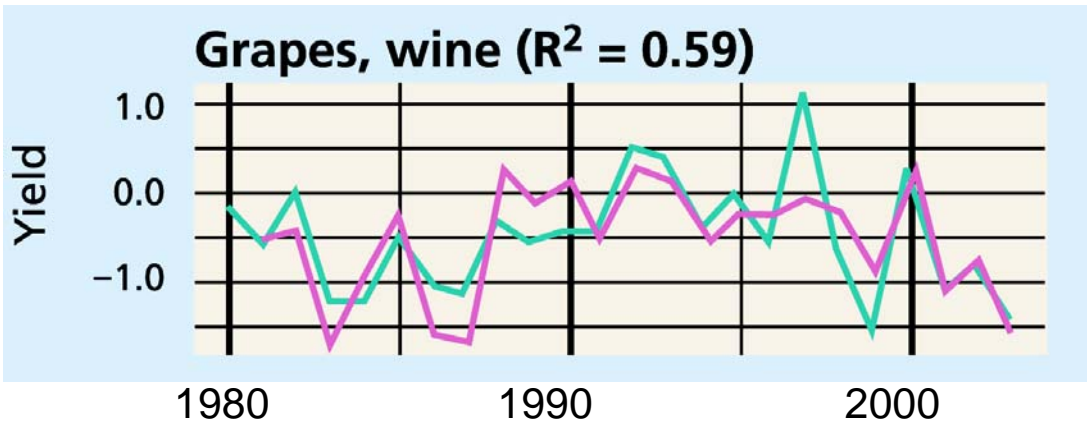
Key Drivers of Wine Grape Yields



Surprising for irrigated crop in Mediterranean climate!

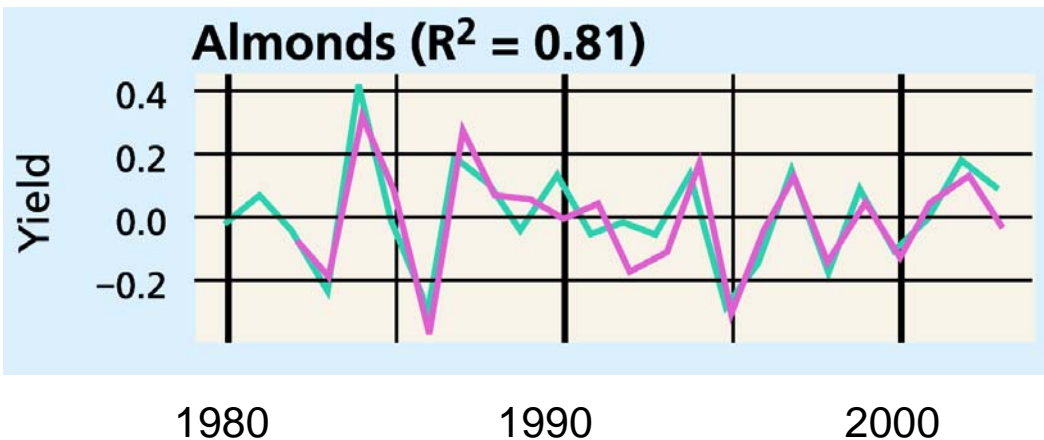
- High wine grape yields favored by:
- warm April, wet June, wet Sept before harvest ($R^2=0.62$)

“Forecasting” within-season yields



Increased
lead time Forecast
right
direction

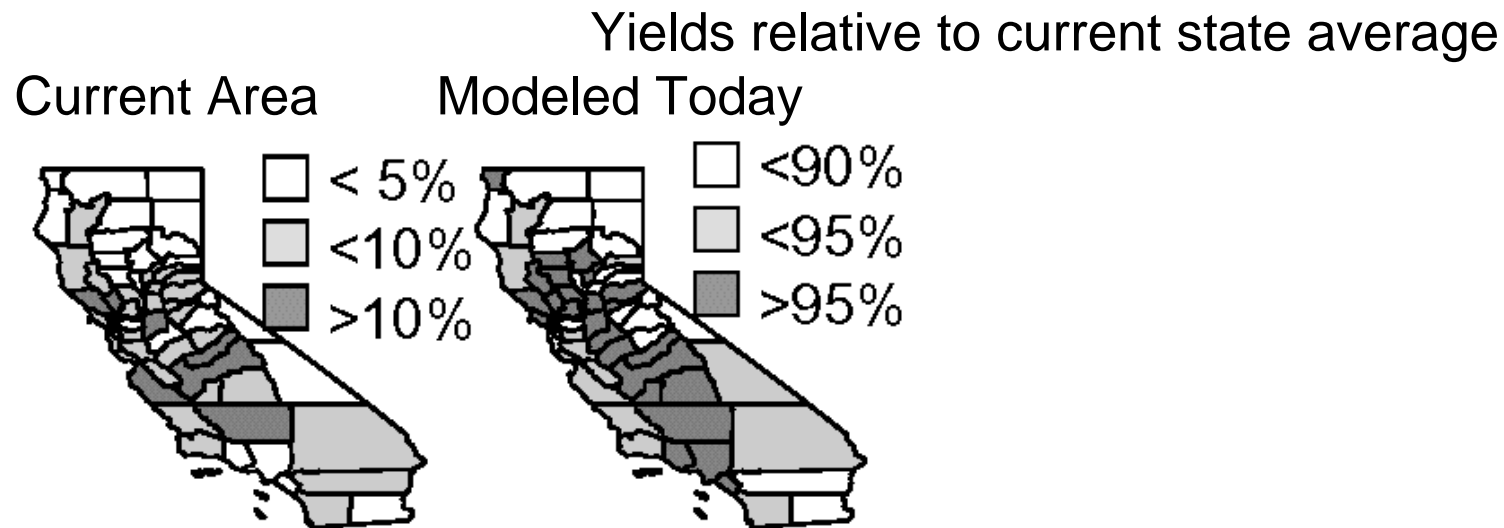
1-2 months 61%



4 months 73%

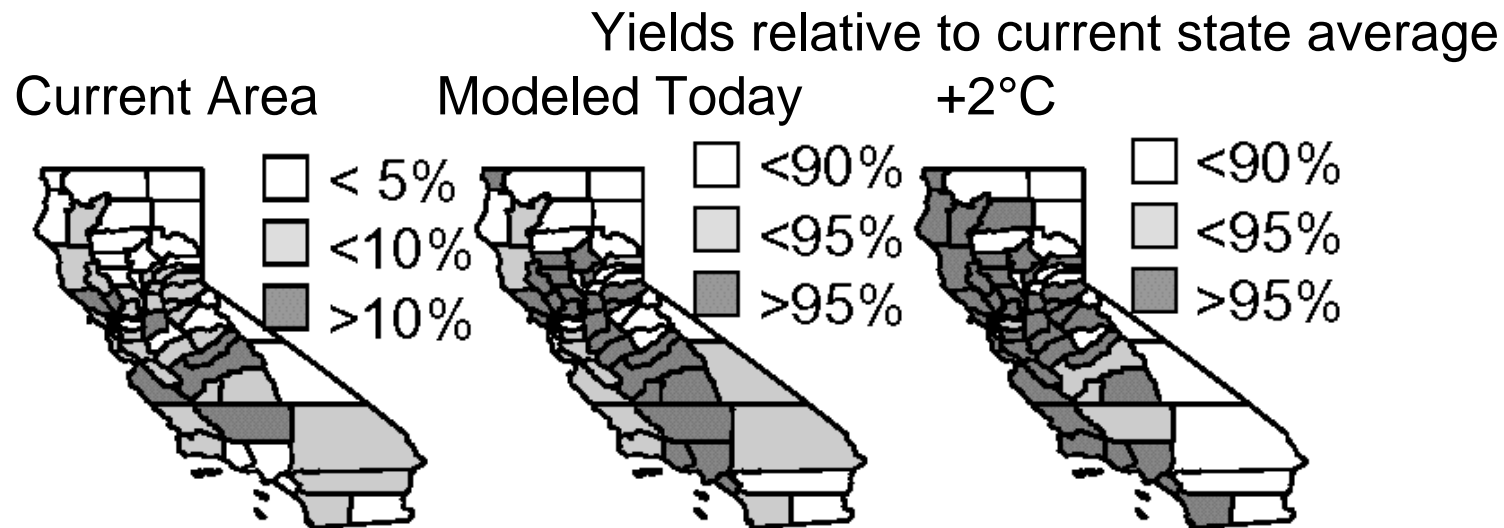
— Forecast yields
— Observed yields

Projecting future winegrowing areas



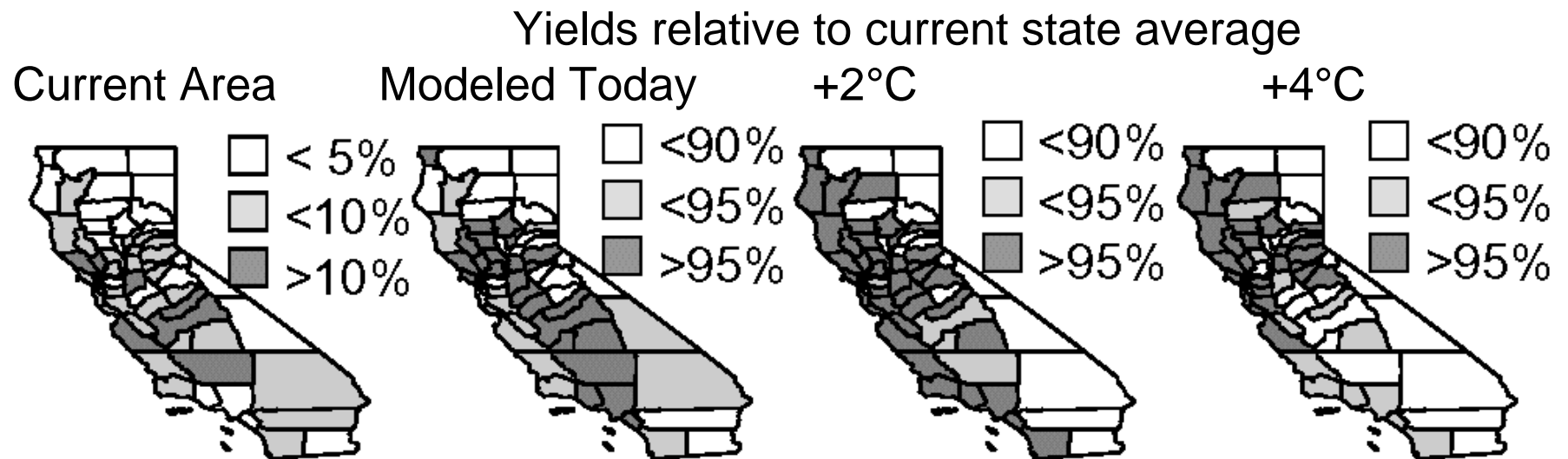
Favorable Counties	25
Overlap	81%

Projecting future winegrowing areas



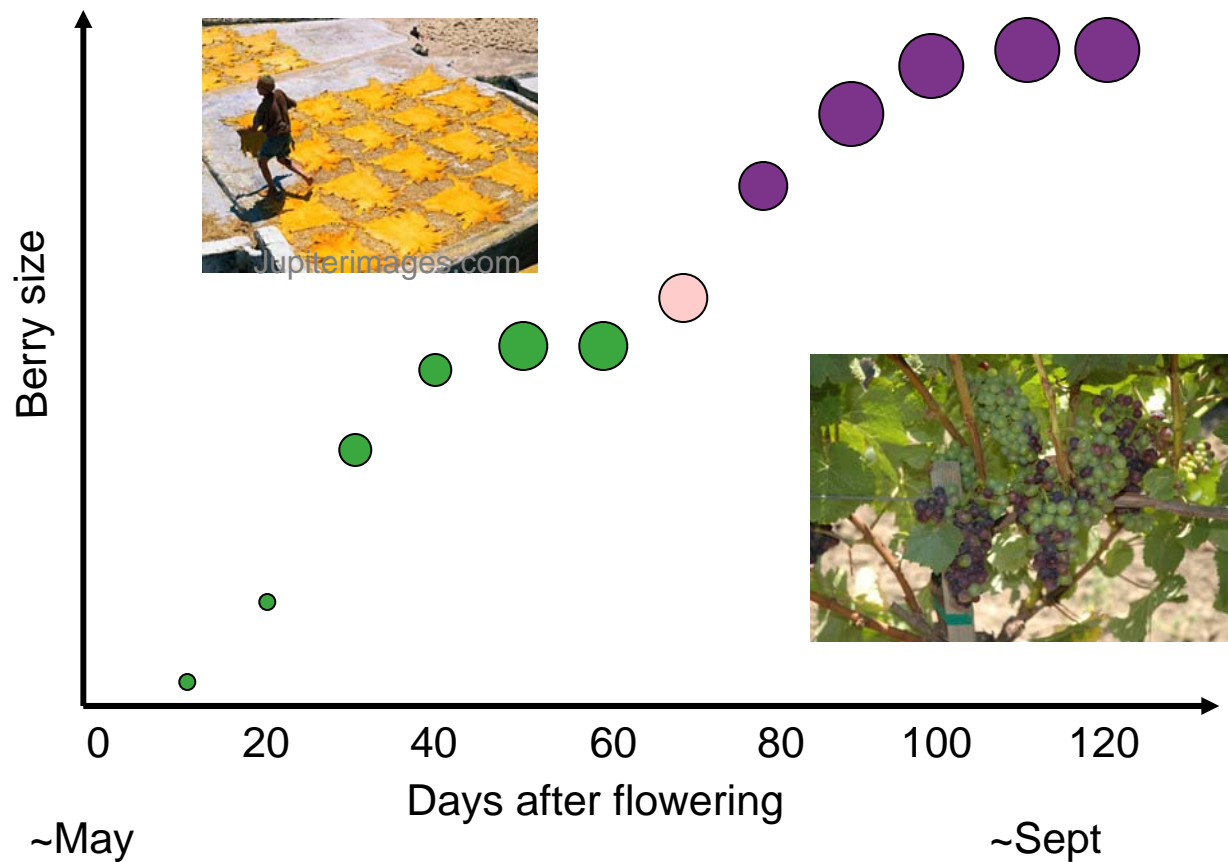
Favorable Counties	25	38
Overlap	81%	77%

Projecting future winegrowing areas



Favorable Counties	25	38	26
Overlap	81%	77%	33%

Grape Composition & Development



3-year
field study of
Pinot noir in
Sonoma and
Napa

Accumulation of:

Tannin

Anthocyanin

After Kennedy, 2002, *PWV*

Climate Influence on Grape Composition

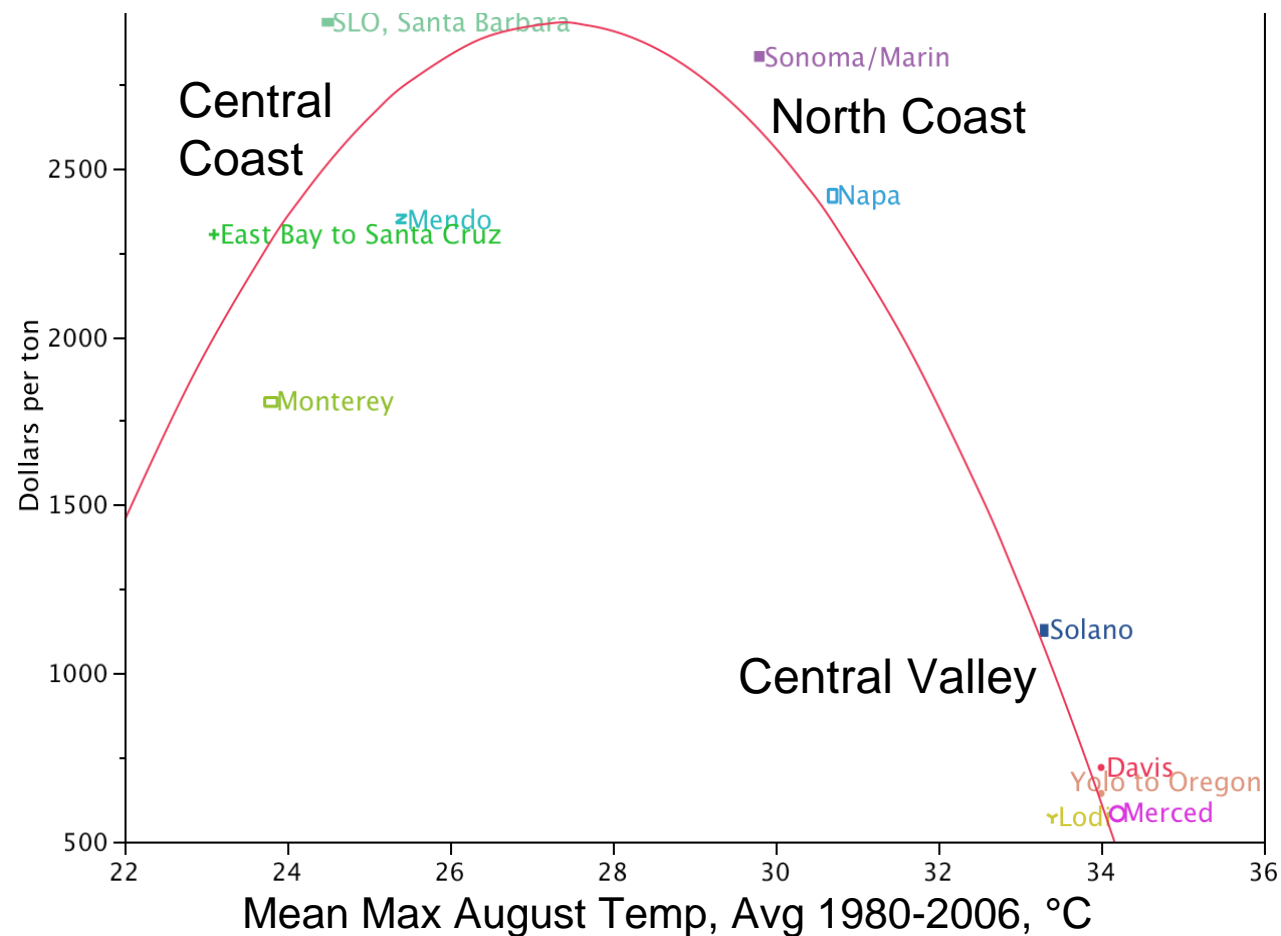


	Harvest	Dormant	Budburst	Bloom	Veraison	Harvest
Anthos	Cool		Hi range cool 16<temp<22			
Tannin	Cool		Warm		Cool	

Color maximized by cool fall and summer, moderate ripening ($R^2=0.64$)

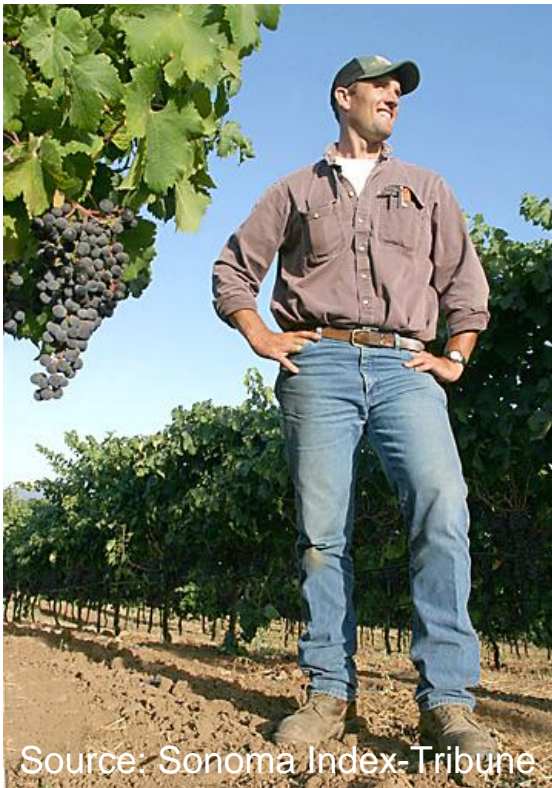
Tannin maximized by cool fall, warmer winter, cool ripening ($R^2=0.56$)

Ripening Temperature and Pinot noir Price in California



Cahill, Field, Matthews, and Lobell, in prep

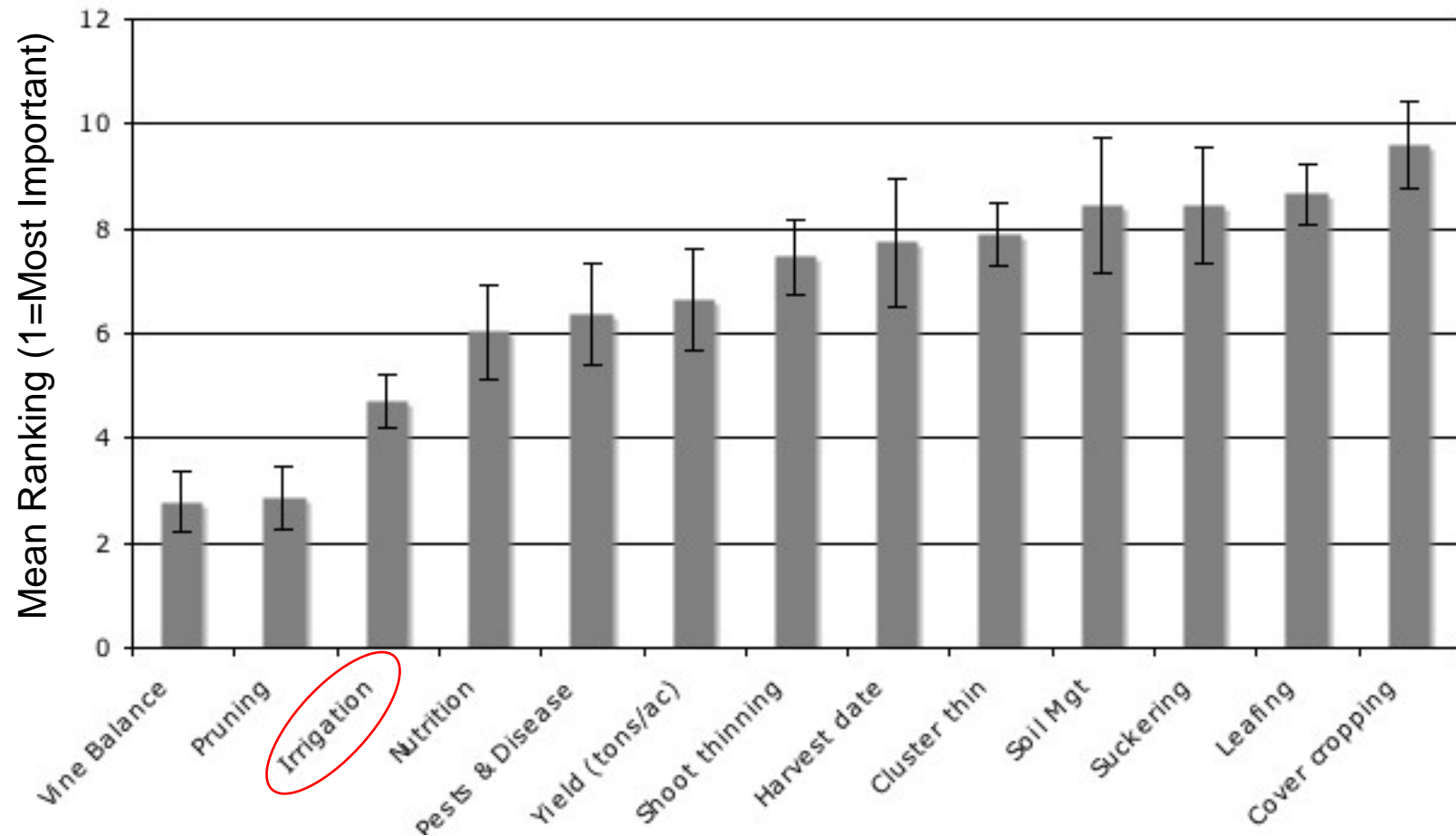
Interviews with Growers



Source: Sonoma Index-Tribune

- Semi-structured interviews, ~2 hours each
- Views on quality factors, management practices, and decision-making
- Coding of open-ended responses and analysis of ranking exercise
- 20 growers
 - 18 men, 2 women
 - Ages 29-65
 - 10 vineyard managers/viticulturalists
 - 5 winemakers
 - 5 owners

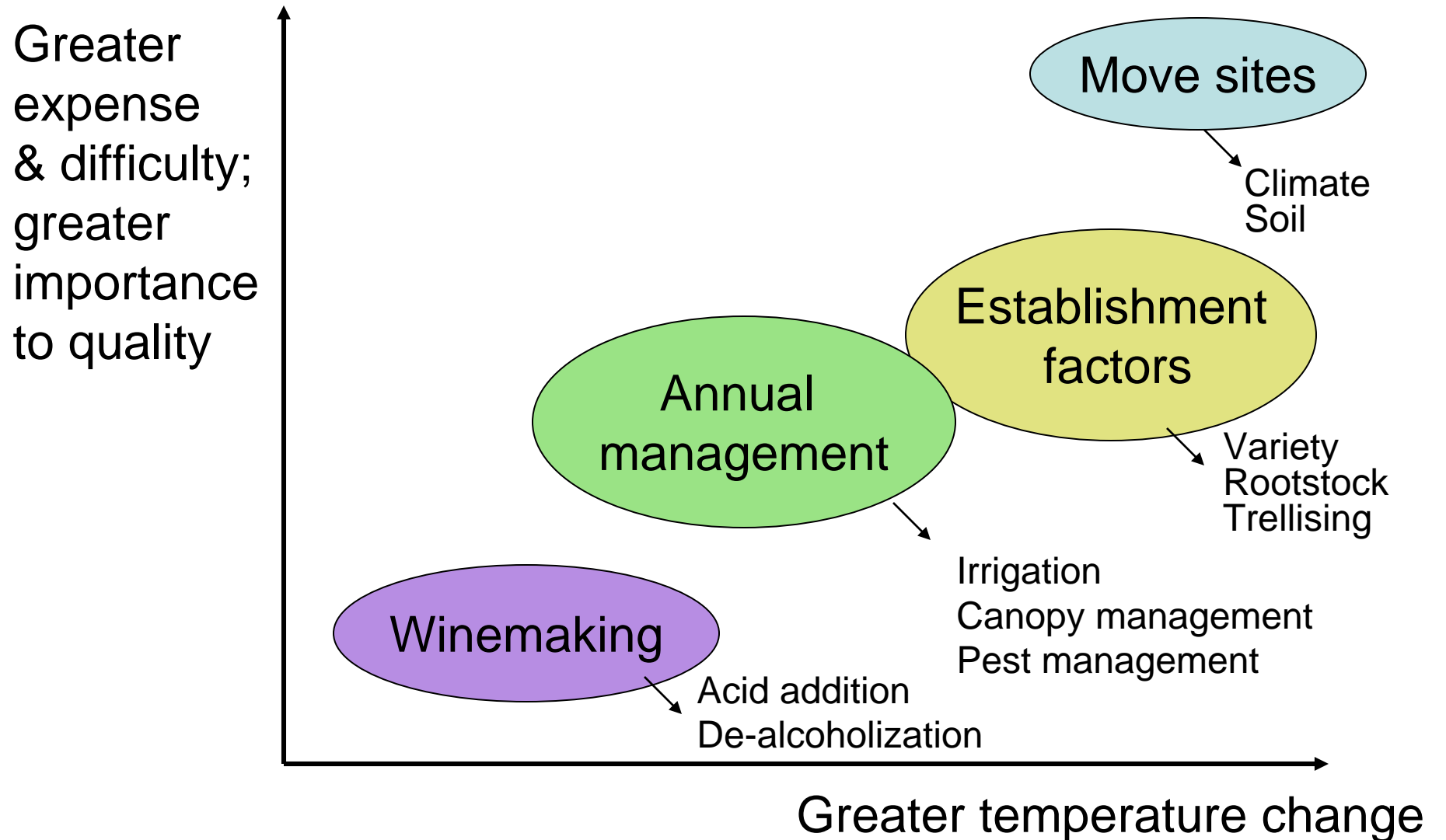
Management Rankings



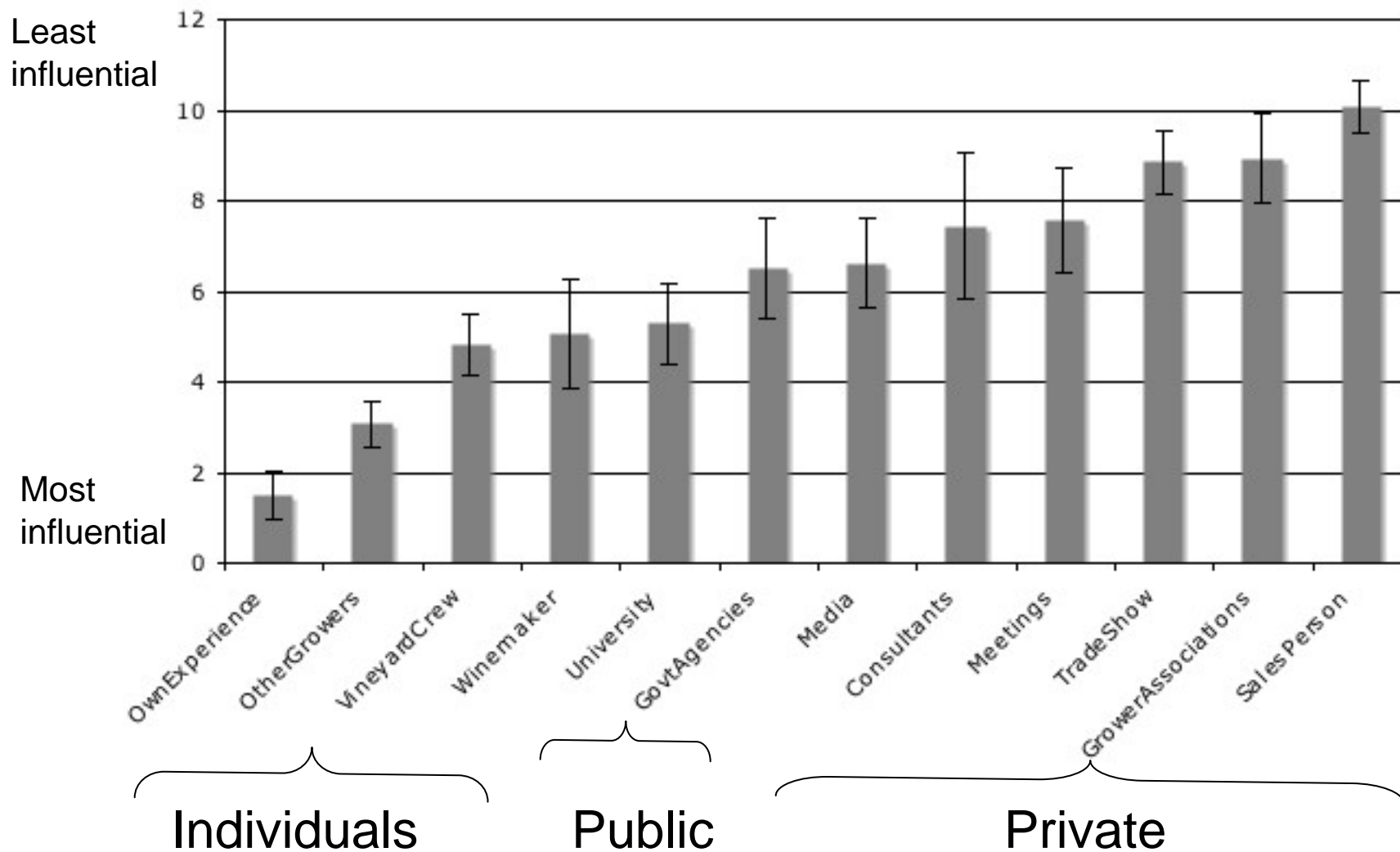
Most important

Least important

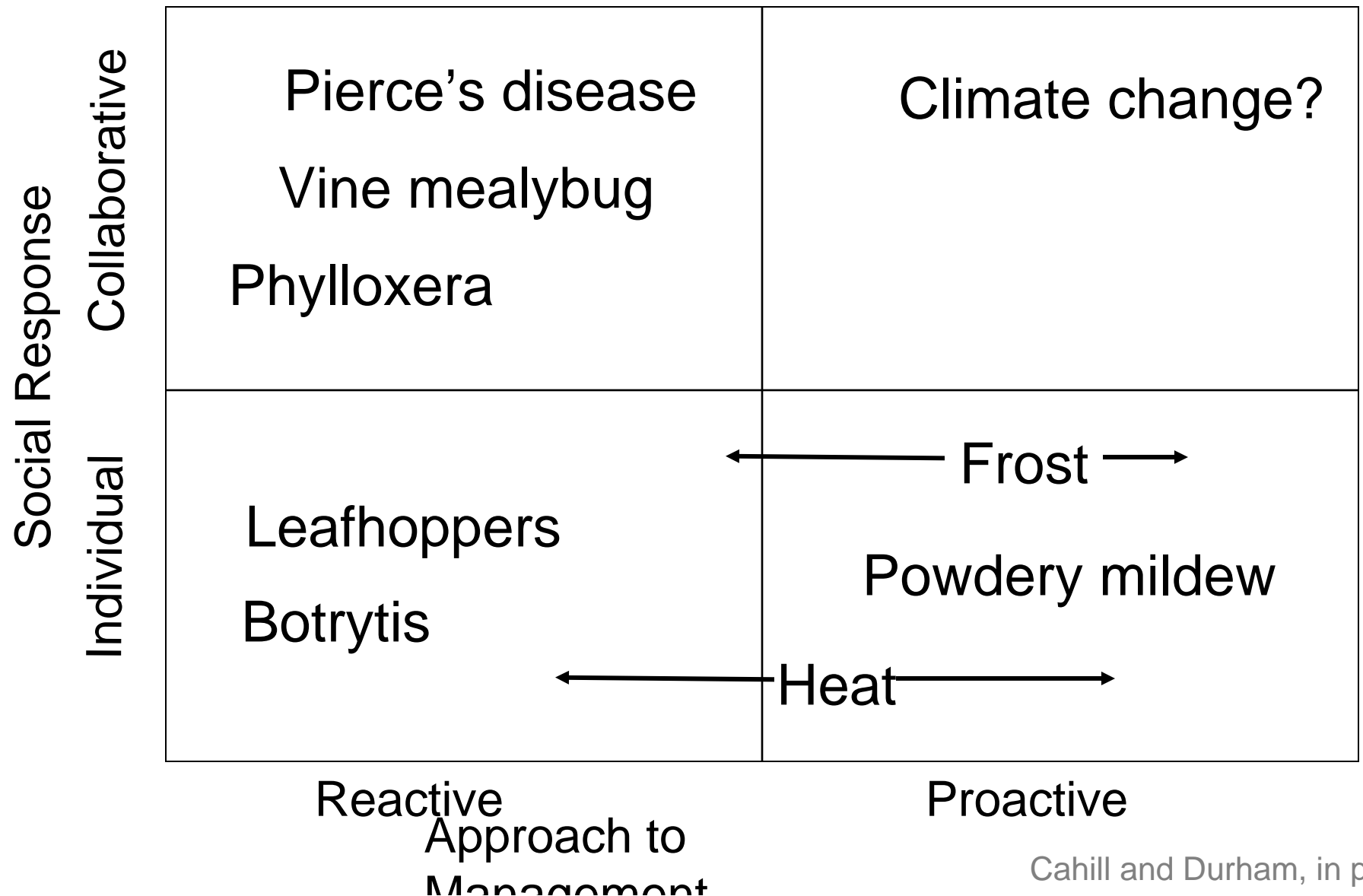
Vineyard-scale Adaptation Options



Growers Rely on Own Experience

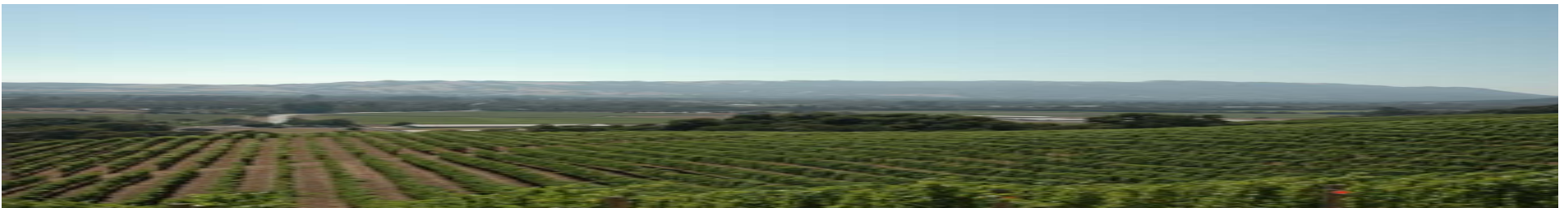


Vineyard-level Adaptation Strategies



Summary

- Warmer temperatures may reduce winegrape yields and quality parameters
 - Statewide, California is within 1°C of optimal spring temperatures for winegrape yields.
 - Tannins and color in Pinot noir vineyards were decreased by higher spring and summer temperatures
- Growers report that site factors are essential to quality
 - Industry believes climate & irrigation are very important
 - Management to adapt to warming becomes increasingly difficult with greater warming
- Grower management responses tend to be reactive, individual, and based on personal experience
 - Effective partnerships; proactive and collective responses





Thanks!

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